УДК 644.644 doi: 10.20998/2220-4784.2020.06.10

N. V. KONDRATIUK, Ye. A. POLYVANOV, O. Yu. VIENKO, I. P. HONCHARENKO

SCIENTIFIC ASPECTS OF DEVELOPMENT AND ENRICHMENT OF DRY MIXTURES FOR THE PRODUCTION OF GLUTEN-FREE CULINARY PRODUCTS

The article is devoted to a relevant topic aimed at solving the problem of expanding the range of gluten-free food products. The production of gluten-free products is associated not only with congenital pathology - celiac disease, but also with a sharp decrease in the enzymatic activity of assimilating proteins, not only wheat flour. The main share in the Ukrainian market of such goods is occupied by imported products, which are much more expensive, or domestic products, but containing expensive imported components. As a result of research, a recipe for gluten-free pancakes was developed based on a mixture of dry ingredients with corn, rice, amaranth flour. The optimum moisture content of the dough and the dosage of components for baking at home or in the conditions of restaurant enterprises have been established. A technology for preparing dough from a mixture by adding a hydromodule followed by a short-term exposure is proposed. It is shown that the exposure of a mixture of dry components has a positive effect on the taste and quality of culinary flour products, and the use of an enzyme complex, amaranth flour and a double-acting baking powder makes it possible to increase the form-holding capacity of the dough and finished products after heat treatment. Calculations of the cost and nutritional value of gluten-free pancakes based on a mixture of dry components have been made. The results obtained prove that the developed products do not contain gluten, are characterized by increased biological value and lower cost in comparison with existing analogues.

Keywords: gluten-free flour, amaranth flour, product cost, nutritional value, bakery enzymes

Н. В. КОНДРАТЮК, Є. А. ПОЛИВАНОВ, О. Ю. ВІЄНКО, І. П. ГОНЧАРЕНКО

НАУКОВІ АСПЕКТИ РОЗРОБКИ ТА ЗБАГАЧЕННЯ СУХИХ СУМІШЕЙ ДЛЯ ВИРОБНИЦТВА БЕЗГЛЮТЕНОВИХ КУЛІНАРНИХ ВИРОБІВ

Стаття присвячена актуальній темі, спрямованій на вирішення проблеми розширення асортименту безглютенових продуктів харчування. Виробництво безглютенової продукції пов'язане не тільки з вродженою патологією - целіакією, а також з різким зниженням ферментної активності засвоєння білків не тільки пшеничного борошна. Основну частку на українському ринку подібних товарів займають продукти імпортного виробництва, які значно дорожче, або продукти вітчизняного виробника, але містять дорогі імпортні складові. В результаті досліджень розроблена рецептура безглютенових панкейків на основі суміші сухих компонентів з кукурудзяного, рисового, амарантового борошна. Встановлено оптимальну вологість тіста і дозування компонентів для випікання в домашніх умовах або в умовах підприємств ресторанного господарства. Запропоновано технологію приготування тіста з суміші шляхом додавання гідромодуля з подальшою нетривалою експозицією, що позитивно впливає на смак і якість кулінарних борошняних виробів, а використання ензимного комплексу, борошна амаранту і розпушувача дозволяє підвищити формоутримуючу здатність тіста та готових виробів після теплової обробки. Отримані результати доводять, що розроблені вироби не містять глютену, характеризуються підвищеною біологічною цінністю і більш низькою собівартістю в порівнянні з існуючими аналогами.

Ключові слова: безглютенова продукція; амарантове, рисов та, кукурудзяне борошно; ензими; біологічна цінність.

Н. В. КОНДРАТЮК, Е. А. ПОЛИВАНОВ, А. Ю. ВИЕНКО, И. П. ГОНЧАРЕНКО

НАУЧНЫЕ АСПЕКТЫ РАЗРАБОТКИ И ОБОГАЩЕНИЯ СУХИХ СМЕСЕЙ ДЛЯ ПРОИЗВОДСТВА БЕЗГЛЮТЕНОВЫХ КУЛИНАРНЫХ ИЗДЕЛИЙ

Статья посвящена актуальной теме, направленной на решение проблемы расширения ассортимента безглютеновых продуктов питания. Производство безглютеновой продукции связано не только с врожденной патологией - целиакией, но и с резким снижением ферментной активности усвоения белков не только пшеничной муки. Основную долю на украинском рынке подобных товаров занимают продукты импортного производства, которые значительно дороже, или продукты отечественного производителя, но содержащие дорогостоящие импортные составляющие. В результате исследований разработана рецептура безглютеновых панкейков на основе смеси сухих компонентов из кукурузной, рисовой, амарантовой муки. Установлена оптимальная влажность теста и дозировка компонентов для выпекания в домашних условиях или в условиях предприятий ресторанного хозяйства. Предложена технология приготовления теста из смеси путем добавления гидромодуля с последующей недлительной экспозицией, что положительно влияет на вкус и качество кулинарных мучных изделий, а использование энзимного комплекса, муки амаранта и разрыхлителя позволяет повысить формоудерживающую способность теста и готовых изделий после тепловой обработки. Полученные результаты доказывают, что разработанные изделия не содержат глютена, характеризуются повышенной биологической ценностью и более низкой себестоимостью в сравнении с существующими аналогами.

Ключевые слова: безглютеновая продукция; амарантовая, рисовая и кукурузная мука; энзимы; биологическая ценность.

intake is exacerbated for people every year. This is primarily due to the low solvency of the majority of the world's population, the low standard of living of the majority of the population, even in developed countries. Secondly, even with sufficient wealth, the proteins that come for assimilation are mostly unbalanced and far from "ideal" . The third reason is low enzyme activity, which is lost due to hypodynamic lifestyle and constant stress. Disruption of protein digestion leads to the accumulation of breakdown intermediates, which over time can turn into fats or begin to decompose and form difficult to excrete toxic substances. Therefore, the to these problems dictates the creation of modern food technologies with high biological value, high level of digestibility and digestibility of proteins that have a composition as close as possible to the "ideal protein".

Celiac disease, as a special case of protein digestion disorders associated with autoimmune system disorders and the presence of inflammatory diseases, has become an impetus in creating common approaches to the development of food technologies.

According to [1], gluten-free foods are gaining popularity every year, because according to most consumers (especially young people and women) are associated with diet, weight control, high nutritional value and more. One of the main criteria of competitiveness is the price, because according to the results of analytical studies [2] the price of gluten-free products is almost twice as much as 100 g than their counterparts in wheat flour or oatmeal.

According to a preliminary review, the market for gluten-free products (bakery products, snacks and ready-to-eat foods, pizza and pasta, condiments and dressings) is growing [3]. Also, when expanding the range, it is necessary to focus not only on the cost of the product, but also on the attractive sensory characteristics and cooking capabilities both at home and in restaurants. That is to adhere to the slogan: "economical, convenient, fast, useful".

Analysis of literature data and problem statement. The expediency of creating new recipes and technologies of specialized products is due to their high demand among the population and a limited range [4]. This includes gluten-free foods, indispensable in the daily diet of people with celiac disease [5], or those who carefully take care of their own weight.

In addition to congenital, celiac disease can be acquired, provoked by excessive consumption of high-gluten vegetable protein, severe emotional stress or prolonged pathological effects of other negative factors. Undiagnosed celiac disease, exacerbated by prolonged intoxication with cereal gluten, is one of the causes of secondary immune disorders - type 1 diabetes, mental retardation, ulcers and tumors in the mouth and gastrointestinal tract, epilepsy and some other diseases. .

The main method of treatment of celiac disease is strict lifelong adherence to a gluten-free diet [6, 7].

According to existing facts, almost 1% of the world's population belongs to patients with celiac disease, and 5% of the world's population - are predisposed to this disease and also require a strict diet [8]. Therefore, today it is quite popular to follow a gluten-free diet for people who do not have a clinically confirmed diagnosis, in order to prevent celiac disease and its accompanying symptoms.

Currently, a small set of products (Gluten free products) is used in world practice, where gluten-free cereals such as rice, buckwheat, corn, millet and amaranth are used as basic ingredients [9–12].

Some clinical studies show that patients with celiac disease consume products containing oats without further signs of inflammation of the intestines [13]. However, there is no clear decision on the inclusion of this cereal in a number of gluten-free.

Of interest is the foreign experience of using amaranth in gluten-free foods. It is important to note that amaranth protein has shown no toxicity in patients with celiac disease [14].

Studies have shown that there are many cereals that are "gluten-free" and have a wide range of health benefits. Rice, amaranth, quinoa, corn contain phenolic acids, flavonoids, minerals, vitamins and some trace elements that promote good health. Various studies have shown the anticancer, antimicrobial and anti-inflammatory effects of these cereals, as well as their non-toxic nature, high bioavailability and pharmaceutical activity. However, it should be borne in mind that the consumption of such products should become daily, which in turn emphasizes the need to expand the range of gluten-free products.

The FAO Annual World Food Security Report 2017 reports an increase in malnutrition of 515 million compared to 777 million. Another report by the United Nations Children's Fund (UNICEF, 2009) and the World Health Organization (WHO, 2005) states that about one hundred and fifty million children under the age of 5 in the world suffer from malnutrition and are underweight due to unbalanced contain of protein in food. To overcome these negative aspects and address food security challenges, approaches have been developed to create high-quality culinary semi-finished products that can meet current nutrient and nutraceutical needs for the general population, including those in need of social protection. The research results will be useful for technologists of the food industry and restaurant business to create cases of technologies that provide the population with safe long-term semi-finished products, from which you can easily prepare unique innovative products with functional characteristics and nutraceutical potential effectived to health population.

Rice flour is the leader among all cereals in terms of protein and starch content. Lack of gluten, richness of vitamins, minerals, trace elements and useful properties of rice flour have made it a constant component of baby food and diets. However, when swollen, the dough has a slight rise, and after heat treatment, the baking falls, although have a pleasant taste. Corn flour contains calcium, magnesium, potassium, iron, vitamin B. Rich in starch, easily absorbed by the body. Contains fiber. The taste of corn flour stands out, among the tastes of other types and varieties of flour. The dishes have a bright taste, which does not require further addition of spices. The flour has a slightly sweet taste, during fry, it becomes viscous, and when cooled densed, so it requires the addition of baking powder or structurants. Amaranth is interesting with a high protein content of 12-23%. This is much higher than most other crops. Amaranth protein contains essential amino acids: lysine, isoleucine, methionine, threonine, tryptophan, leucine, the content of which is many times greater than their number in wheat, rice, oats and corn. This makes amaranth protein more complete, increasing its amino acid score to 75. Amaranth is rich in polyunsaturated fatty acids, including omega-6. Compared to other cereals, amaranth grain contains biotin, riboflavin, folacin, as well as tocotrienols and squalene. Amaranth, as well as other cereals, is characterized by a high content of minerals such as potassium, magnesium, selenium and iron [15–18].

The work of researchers of many countries of the world and in particular of the leading Ukrainian scientists, such as: V.I. Drobot, A.M. Grishchenko [19], V.V. Dorokhovych [20], A.M. Dorokhovych [21], O.G. Gubskaya [22], K.G. Iorgachova [23], G.B. Rudavskaya,

N.V. Prytulskaya, E.V. Tishchenko [24], O.V. Babich [25] are devoted to the question of development of technology of gluten-free bakery products.

In Ukraine, the range of gluten-free products is formed mainly through imports (cookies, pasta, bread, pizza bases, chips, candy, dry baking mixes). Among the domestic producers on the market are the products of the brands "World'srice", "Zhmenka", "Ms. Tally","Healthy Tradition "(flour, pasta, bread), which is marked "crossed out spikelet". However, the first manufacturer that in 2019 officially received the right to use this designation was LLC "Cascade" ("Ms. Tally") [26].

However, the issue of amino acid balance and modeling of prescription components is considered for the first time in terms of a high level of digestibility, attractive organoleptic characteristics and effective manufacturability.

General provisions of the experiment. The developed mixture for the manufacture of pancakes as recipe components contains gluten-free types of flour (rice, corn, amaranth). As a supplement to the amino acid composition and as technological components of the mixture, were added egg powder, skim whey, coconut flour. The sweet and aromatic components were a sweet extract of stevia leaves, table salt and vanillin. A mixture of baking enzymes, baking soda and citric acid were used as leavening agents in a ratio that provides a complete flow of the soda neutralization reaction with acid in in a certain amount of water with the release of a sufficient volume of CO_2 gas in finished product, which does not contain foreign flavors. During the analysis of finished products, generally accepted and special methods for assessing the quality and technological properties were used. The total amino acid content was determined by calculation. Standard methods of statistical and correlation analysis (MS Excel application package) were used for statistical processing of experimental data.

Results and discussion. The recipe composition was selected according to organoleptic parameters and taking into account the content of essential amino acids in the flour, to ensure the functional properties of the product. In the table. 1 shows a comparative analysis of the amino acid composition of the mixture for gluten-free pancakes with "ideal protein".

Table 1. Comparative analysis of amino acid composition mixture with "perfect protein"

	g/100 g of "ideal protein"	g / 100 g of the mixture	% of "ideal protein"
Indispensable			
valine	3,5	1,2	33,5
isoleucine	2,8	1,3	45,9
leucine	6,6	2,2	33,9
lysine	5,8	1,7	20,1
methionine (*)	2,5 (0,9)	0,63	36,2
threonine	3,4	0,85	24,9
phenylalanine (**)	6,3 (2,9)	1,7	46,3
Replaceable			
alanine		1,5	
arginine		1,9	
aspartic acid		2,6	
histidine		0,7	
glutamic acid		4,4	
proline		1,2	
serine		1,1	
tyrosine		1,3	
glycine		1,3	
cysteine		0,3	
tryptophan		0,6	

* Methionine + cysteine; ** Phenylalanine + tyrosine

The study of amino acid composition showed that the developed composition contains all essential and substitute amino acids. Essential amino acids are found in amounts up to 20 percent or more in comparison "ideal protein", which proves the high biological value of development.

It should be noted that these data refer to a portion of finished culinary products weighing 260 g. That is, as a recommendation, we can offer for daily consumption such pancakes as a full-fledged replacement of one meal.

These ratios of components allow you to their own production food with high organoleptic characteristics, without spending a lot of time on baking and preparation of raw materials, such as milk and eggs, because all these components, which enrich the finished dish and give it flavor, are included to the composition of the semi-finished product in contrast to the existing domestic and imported analogues, to which producers recommend adding milk and eggs.

The block diagram of the technological process of production of dry gluten-free mixtures for pancakes is presented in Fig. 1. A method of preparing pancakes from this mixture was also developed, which consisted in adding 180 ml of prepared drinking water (t = 20–30 °C) to 100 g of the mixture, thorough rapid mixing to a homogeneous plastic mass, exposition the resulting dough for 15 min, re stirring and then baking in a hot pan for 2-3 min on each side of the product to form a ruddy crust. If necessary, you can add 1-2 ml of oil before baking in a pan or in a mixture prepared for baking.

In the table. 2 shows the organoleptic characteristics of finished culinary products.

In the table. 3 shows the regulated quality indicators for the dry mixture for baking pancakes.

Table 2 Organoleptic characteristics

Name indicators	Mixture for gluten-free pancakes	Gluten-free pancake culinary product
Appearance and consistence	Powdered mixture without foreign inclusions and lumps. All components provided by the recipe are evenly distributed by volume. Inclusions are allowed due to added additives, according to the recipe	The products are round, without gaps at the edges, toasted, the surface is ruddy on both sides.
Color	White with a light cream tint	From golden to light brown
Smell	Weak corn odor without foreign odors, not musty, not moldy. Inherent in this type of product with a pronounced taste and smell of the additives used.	Inherent in the culinary product after frying and the introduced components, pleasant vanilla-coconut taste
Taste	Free of any foreign smell and/or taste	Inherent in the product, with a taste of corn, coconut, sweet, without the taste of baking soda, moderately salted

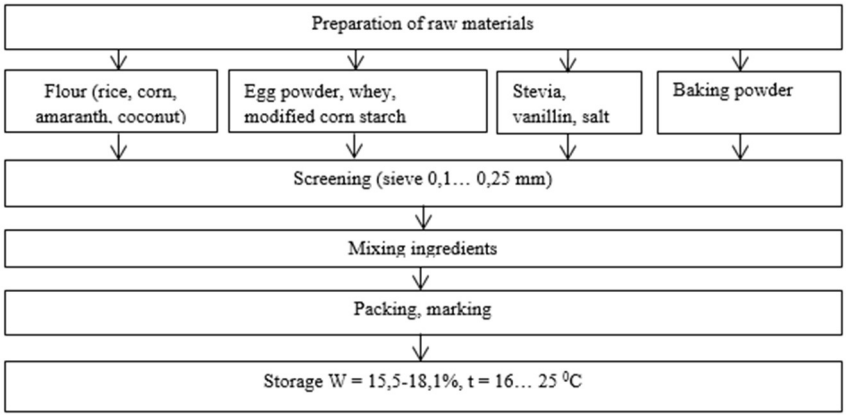

Fig. 1. Technological scheme of production of dry gluten-free mixture for pancakes

Table 3 Regulated indicators of dry gluten-free mixtures for pancakes

Name indicators	Mixture for gluten-free pancakes
Alkalinity, no more, grad.	15,0
Mass fraction of reducing sugars, no less, %	10,0
Mass fraction of moisture, no more, %	10,0
Mass fraction of metal impurities (particles not more than 0.3 mm in the largest linear measurement),%, not more	$3 \cdot 10^{-4}$
Admixture	Not allowed
Infection with pests of grain stocks	Not allowed

The data in the tables prove the high quality of the mixture and ready-made culinary products based on it. Dishes have a high biological and nutritional value and can be competitive in the market of similar goods both in Ukraine and abroad.

Conclusions and prospects for further development of this area. Gluten-free food has become a characteristic feature of nutrition and life in the third millennium. The growing number of patients with gluten intolerance - celiac disease - insufficient enzyme activity of proteases and lipases, lack of complete protein, leads to increased consumption of gluten-free foods, balanced in amino acid composition. In addition, many people around the world have begun to consume gluten-free foods, not only because of the diagnosis of celiac disease, but also because of the general idea of maintaining health and preventing other diseases such as diabetes and obesity. Intensification of marketing activities and improvement of sales channels contribute to the need to produce products that do not contain gluten and have a high biological and nutritional value. The presence of gluten-free semi-finished products for easy cooking makes it possible for those who need and want to change their diet, get healthy and enjoy the relatively wide potential of healthy home cooking.

However, a completely regular part of most consumers' lives is visiting restaurants, cafes, other public catering establishments or catering in hotels while traveling. For people who follow a gluten-free diet, choosing food on vacation and on business trips often becomes a difficult task, as the vast majority of restaurants do not post information about the presence of potential allergens on the menu and do not have the appropriate certificates. This may indicate gluten contamination of foods positioned as gluten-free, which may occur due to cross-contamination in warehouses or production facilities, the use of kitchen utensils that are not properly sanitized after cooking, ignorance of staff and more. Thus, according to an online survey conducted by researchers in the United States (New York), 63% of respondents said that they avoid eating in restaurants due to a gluten-free diet or consume restaurant products much less often than the general public. In general, for this group by of visits to the restourant can often pose a serious health risk.

In Europe, almost every major city has 4-5 restaurants with a gluten-free menu. In ukrainian hospitality establishments of the assortiment of gluten-free products of own production is insignificant and needs expansion. Many companies do not have separate "gluten-free" production facilities and include in the menu purchasing products of foreign production.

Thus, there is a need to expand the range of semi-finished products with a high degree of readiness to

produce healthy and balanced food for people suffering from celiac disease or having problems with protein digestion. Introduction of such mixtures in the production of domestic enterprises with further sale in mass markets, restaurants, cafes, bakeries, cafes, confectioneries, specialized cafes, as well as restaurants at hotels, sanatoriums, clinics and other health facilities with sports, children's and herodietic services and dietary nutrition is important for the implementation of public health strategies.

References (transliterated)

1. Christoph Mary J., Larson N., Katie C. Hootman., Jonathan M. Miller., Dianne Neumark-Sztainer. Who Values Gluten-Free? Dietary Intake, Behaviors, and Sociodemographic Characteristics of Young Adults Who Value Gluten-Free Food. Journal of the Academy of Nutrition and Dietetics. Vol. 118, № 8, 2018, pp. 1389-1398. https://doi.org/10.1016/j.jand.2018.04.007
2. Sara Capacci, Anna Caterina Leucci, Mario Mazzocchi. There is no such thing as a (gluten-)free lunch: Higher food prices and the cost for coeliac consumers. Economics & Human Biology Vol. 30, 2018, pp. 84-91. https://doi.org/10.1016/j.ehb.2018.06.001
3. H.L. de Kock, N.N. Magano. Sensory tools for the development of gluten-free bakery foods Journal of Grain Science Vol. 94, 2020, Article 102990. https://doi.org/10.1016/j.jcs.2020.102990.
4. I. YU. Reznichenko, O. YU. Yehorova. Teoretychni aspekty rozrobky ta klasyfikatsiyi kondyters′kykh vyrobiv spetsializovanoho pryznachennya. Tekhnika i tekhnolohiya kharchovykh vyrobnytstv. № 3, 2013, pp. 133-138.
5. Kopishinskaya S. V. Suchasni uyavlennya pro tseliakiyi. Kazans′kyy medychnyy zhurnal, 2016, T. 97, № 1, pp. 101-107. https://doi.org/10.17750/KMJ2016-101
6. D.S. Mykhalyk i in. Tseliakiya: khvoroba i sposib zhyttya. Zems′kyy likar, 2012, № 4, pp. 35-38.
7. M.L. Haines, R.P. Anderson, P.R. Gibson. Systematic review: The evidence base for long-term management of coeliac disease. Alimentary Pharmacology & Therapeutics, 2008, № 28, p. 1042-1066.
8. Rynok bezhlyutenovoyi produktsiyi. Kharchova industriya. 2017, № 1 (31), pp. 8-10.
9. Bel′mer, S.V. Epidemiolohiya tseliakiyi: fakty i vysnovky. Likuyuchyy likar. 2013, № 1, pp. 16-19.
10. R. Ciccocioppo, P. Kruzliak, G.C. Cangemi [et al.]. The Spectrum of Differences between Childhood and Adulthood Celiac Disease. Nutrients, 2015, Vol. 7, № 10, pp. 8733-8751. DOI: https://doi.org/10.3390/nu7105426.
11. N. V. Zhuravs′ka, A. I. Petrova, N. V. Turkina. Tseliakiya u ditey. Medychne sestra. 2005, № 5, pp. 4-7.
12. I. Aziz, N.R. Lewis, M. Hadjivassiliou [et al.]. A UK study assessing the population prevalence of self-reported gluten sensitivity and referral characteristics to secondary care. European Journal of Gastroenterology and Hepatology. 2014, Vol. 26, № 1, pp. 33-39. DOI: https://doi.org/10.1097/01.meg.0000435546.87251.
13. O. Pulido, Z. Gillespie, M. Zarkadas [et al.]. Introduction of oats in the diet of individuals with coeliac disease: A systematic review. Advances in Food and Nutrition Research. 2009, Vol. 57, - pp. 235-285. DOI: https://doi.org/10.1016/ S1043-4526 (09) 57006-4
14. P. Bergamo, F. Maurano, G. Mazzarella [et al.]. Immunological evaluation of the alcohol-soluble protein fraction from gluten-free grains in relation to celiac disease. Molecular Nutrition and Food Research. 2011, Vol. 55, № 8., pp.1266 - 1270. DOI: https: //doi.org/ 10.1002/mnfr. 201100132.
15. H. I. Vysochyna. Amarant (Amaranthus L.): khimichnyy sklad i perspektyvy vykorystannya. Khimiya roslynnoyi syrovyny. 2013, № 2, pp. 5-14. DOI: https: //doi.org/ 10.14258/ jcprm.1302005.
16. P. F. Kononko, V. K. Hins, M. S. Hins. Amarant - perspektyvna kul′tura XXI stolittya. -M.: Rosiys′kyy universytet druzhby narodiv, 1999, pp. 296.
17. B.D. Joshi, R.S. Rana. Grain amaranthus: The future food crop, 1999, p. 152.
18. Kondratiuk N., Suprunenko K., Sytnyk K. I. Comparative evaluation of the biological value of various types of gluten-free flourfor producing beverages Pratsi Tavriys′koho derzhavnoho ahrotekhnolohichnoho universytetu naukove fakhove vydannya / TDATU. Melitopol′: TDATU, 2020. -Vyp. 20, t. 1, pp. 124-132.
19. V.I. Drobot, A.M. Hryshchenko. Tekhnolohichni vlastyvosti bez·hlyutenovoyi syrovyny. Odes′ka natsional′na akad. kharchovykh tekhnolohiy. Nauk. pratsi, vyp. 46, 1, pp. 162-167.
20. I. V. Tarasenko, V. V. Dorokhovych. Netradytsiyni vydy boroshna pry vyhotovlenni vafel′nykh lystiv dlya khvorykh na tseliakiyu. Dytyache kharchuvannya: perspektyvy rozvytku ta innovatsiyni tekhnolohiyi zbirnyk prats′ Druhoyi spetsializovanoyi naukovo-praktychnoyi konferentsiyi v ramkakh XVII Mizhnarodnoho forumu tovariv i posluh dlya ditey «Baby expo», 2014 , Kyyiv : 2014, pp. 28-32.
21. A.M. Dorokhovych, V.V. Dorokhovych, N.P. Lazorenko, I.V. Tarasenko. Bezhlyutenovi boroshnyani kondyters′ki vyroby dlya ditey khvorykh na tseliakiyu. Dytyache kharchuvannya perspektyvy rozvytku ta innovatsiyni tekhnolohiyi. Persha mizhn.konfer.spetsializovanykh nauk., - K., 2013, pp. 71-73.
22. O. YU. Hubs′ka. Nove rozuminnya spektra hlyutenzalezhnykh zakhvoryuvan′. Natsional′nyy medychnyy universytet imeni O. O. Bohomol′tsya. Suchasna hastroenterolohiya Kyyiv. № 1 (75) 2014, pp. 160-165.
23. K.G. Iorgachova, O.V. Makarova, E.N. Kotuzaki. The influence of gluten-free on the quality indicators of biscuit semi-finished products. Zernovi produkty i kombikormy. 2016, № 4 pp. 24-29.
24. Rudavs′ka H.B., Tyshchenko YE. V., Prytul′s′ka N.V. Naukovi pidkhody ta praktychni aspekty optymizatsiyi asortymentu produktiv spetsial′noho pryznachennya. Kyyiv. nats. torh.-ekon. un-t, 2002. pp. 371.
25. Babich O.V., Vikhot′ M.M. Problematyka zabezpechennya spetsial′nymy produktamy kharchuvannya khvorykh na tseliakiyu v Ukrayini. Problemy starinnya i dovholittya. 2016. T. 25, № 2, pp. 230–234.
26. I.M. Medvid′, O.B. Shydlovs′ka, V.F. Dotsenko .Bez·hlyutenova produktsiya v industriyi hostynnosti: aktual′ni pytannya, problemy ta perspektyvy yikh vyrishennya. Innovatsiyni tekhnolohiyi v hotel′no-restorannomu biznesi materialy IKH Vseukrayins′koyi n-praktychnoyi konferentsiyi, 2020, K. : NUFT, 2020, pp. 34-35.

Надійшла (received) 19.10.2020

Відомості про авторів / Сведения об авторах /About the Authors

Кондратюк Наталія Вячеславівна (Кондратюк Наталья Вячеславовна, Kondratiuk NataliiaVyacheslavivna) – кандидат технічних наук, доцент, завідувач кафедри харчових технологій, Дніпровський національний університет імені Олеся Гончара, м. Дніпро, Україна; ORCID: https://orcid.org/0000-0003-4578-9108; e-mail: kondratjukn3105@gmail.com.

Поливанов Єгор Андрійович (Поливанов Егор Андреевич, Polyvanov Yehor Andriyovych) – студент кафедри харчових технологій, Дніпровський національний університет імені Олеся Гончара, м. Дніпро, Україна;
ORCID: https://orcid.org/0000-0003-4999-5187; e-mail: mr.egor.pv@gmail.com.

Вієнко Олексій Юрійович (Виенко Алексей Юрьевич, Vienko Oleksyi Yuriovych) – асистент кафедри харчових технологій, Дніпровський національний університет імені Олеся Гончара, м. Дніпро, Україна;
ORCID: https://orcid.org/0000-0002-8195-8995; e-mail: alekseyrocknrolla@gmail.com.

Гончаренко Ірина Петрівна (Гончаренко Ирина Петровна, Honcharenko Iryna Petrivna) –Дніпровський національний університет імені Олеся Гончара, асистент кафедри харчових технологій; м.Дніпро, Україна;
ORCID: https://orcid.org/0000-0001-9349-254X; e-mail: goncharenkoira88@ukr.net.